TECHNIQUES OF SCREENING*

MARGARET M. KILCOYNE, M.D.

Assistant Professor, Department of Medicine
Columbia University College of Physicians and Surgeons
New York, N.Y.

THERE is one feature of a program for the detection and control of hypertension that contributes in a major sense to ultimate success: continuity. By this I mean a continuous presence, continuity of care, and continuity of credibility and availability. Figure 1 shows an example of failure of continuity.[1] Why did only 8% of persons found to have elevated blood pressure on first screening register in the hypertension clinic? Apparently all the key steps had been taken: establishment of a hypertension program in the community-based hospital (Harlem Hospital Center), provision of immediate access to an all-day hypertension clinic, a walk-in rescreening clinic away from the hospital, and the distribution of color-coded awareness cards and letters of information and instruction at the site of screening and in follow-up. The fault lies in the transient setting of the initial screening. When blood pressures are measured at health fairs, supermarkets, and similar unstructured settings, the essential links to eventual care are absent; the major burden of follow-up therefore devolves upon the patient. Subsequent establishment of stable sites within apartment complexes obliterated this gap in continuity.

When a program for the screening of blood pressure is begun, an analysis of the community should be made in order to take advantage of available assets and to take into account the expected prevalence of hypertension. Figure 2 shows that the actual prevalence of hypertension in the Harlem community[1] was even greater than the prevalence expected according to the National Health Survey,[2] especally in persons aged 21 to 55 years. Where almost one third of the community has the potential for developing hypertension, this factor alone establishes the necessity for a sizeable screening group as well as for appropriate therapeutic facilities. Other communities may be expected to have lower prevalence of hypertension, but also may be farther from the treatment center.[3]

*Presented in a panel, Case Finding, as part of a *Symposium on Developing and Managing Community Programs for the Control of Hypertension* held by the New York Metropolitan Regional Medical Program at the New York Academy of Medicine April 15, 1975.

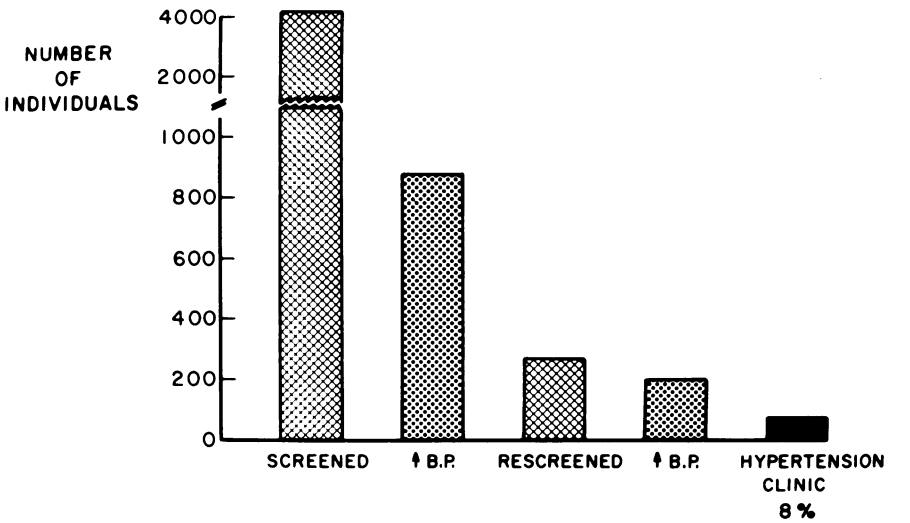

Fig. 1. Imperfections in scattered-site screening for hypertension. Only 8% of subjects found to have elevated blood pressure (↑ B.P.) registered in the Hypertension Clinic. The explanation for this resides in the transient setting of the screening sites—supermarkets, health fairs, and the like—which fail to provide continuity of care. Reproduced by permission from Kilcoyne, M. M.: Hypertension and heart disease in the urban community. *Bull. N. Y. Acad. Med. 49*:501, 1973.

After the assets of the community have been surveyed, links with the treatment center should be made, the form of the program should be determined, and a program of training begun. The order of setting up the program is:

1) Establishment of links with the treatment center when the treatment is to be given by private physicians rather than in clinics, consultative links with the local teaching hospital and a half-day workshop will insure cooperation and long-term benefits.

2) Initial measurement of blood pressure and counseling of the patient.

3) Repeated measurements of blood pressure and referral to the treatment center.

4) Measurements of blood pressure between physicians' visits if the patient is referred back to the screening clinic.

The screening team should be selected and trained with greater attention to the qualities of the person than to his previous experience. The desired endpoint is the formation of a reliable screening group that can establish contact with people, make consistently accurate measurements, and give

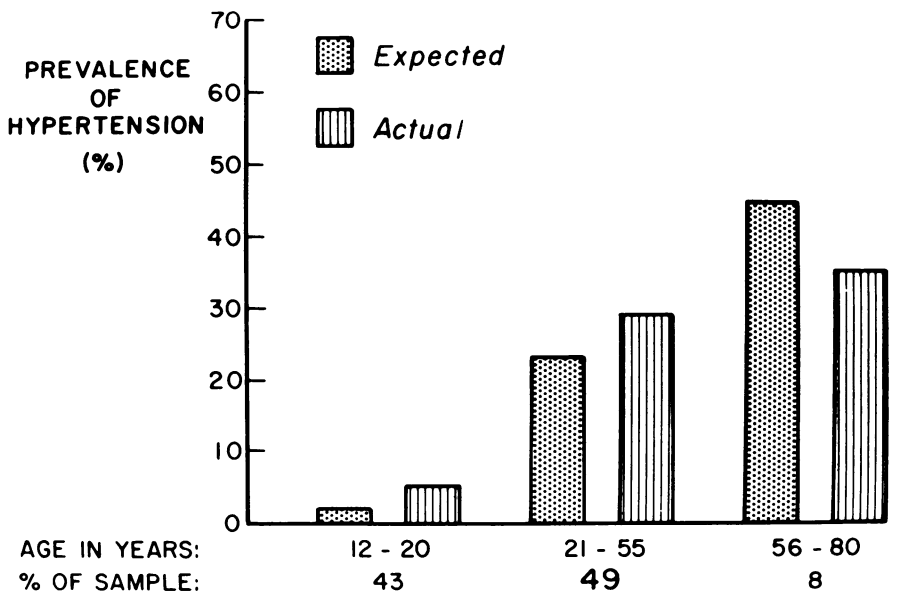

Fig. 2. Actual incidence of hypertension in males in the Harlem community compared with the prevalence expected based upon the National Health Survey conducted by the National Center for Health Statistics, Washington, D.C. The expected prevalence of hypertension in a community forms part of the analysis required before a blood-pressure screening program is established. In the Harlem community the actual prevalence of hypertension exceeded the expectations derived from the National Health Survey, especially in the age group 21 to 55 years, in both males (shown above) and females. Reproduced by permission from Kilcoyne, M. M.: Hypertension and heart disease in the urban community. *Bull. N. Y. Acad. Med. 6:501, 1973.*

accurate but limited advice. The training of the screener should be continuous. At the outset, one month is the minimum training period that should be given before contact with patients is permitted. Subsequent supervision is mandatory. The technique of measurement should be uniform; a mercury manometer is satisfactory. The subject should be removed from the group to be screened and seated quietly. The first and fifth (disappearance of sound) Korotkoff sounds should be used as the systolic and diastolic pressures, respectively. Additional refinements of the technique can be taught easily in the classroom. However, the measurement of blood pressure under actual conditions of screening differs so that noise, fatigue, distraction, and repetition must be considered. These factors make a maximum schedule of 25 measurements per day per person seem a reasonable limit. The results of screening and conversations with patients should

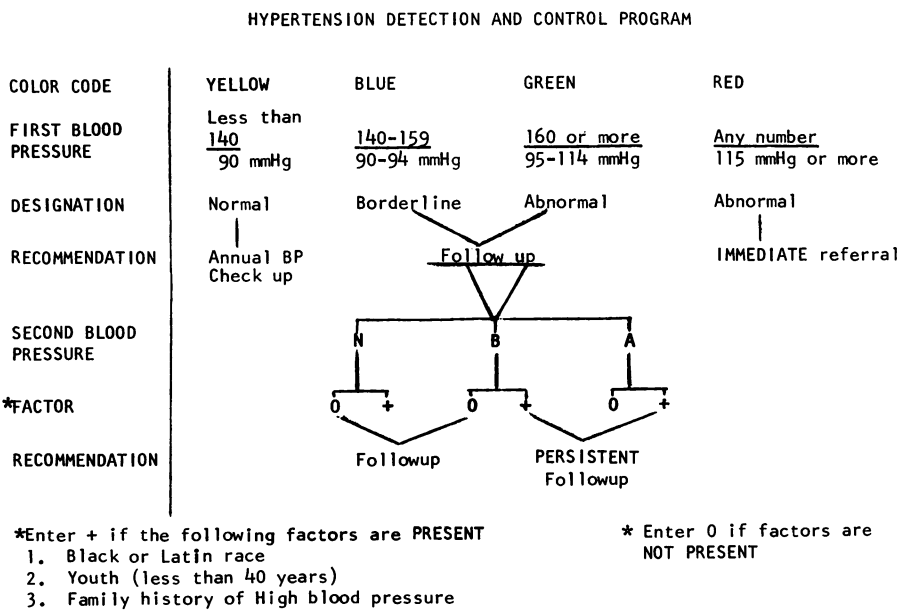

Fig. 3. The over-all design of a specific protocol for screening. The color code is useful as a reinforcement for both the screeners and the subjects screened. The blood-pressure designations are arbitrary but serve as group reference points. The second measurement of blood pressure (N = normal, B = borderline, A = abnormal) is weighted according to factors of race, age and family history.

be reviewed daily by the director of screening. The amount of time that this will require will depend on the stage of advancement of the screener and of the program. The protocol should be specific. Arguments as to the specificity of criteria for borderline or abnormal blood pressure are far less important for adults than for the adolescent age group. It is important to emphasize the fact that the system being measured is highly dynamic and that variability is the rule rather than the exception. As in most groups, the borderline instances are the most difficult to assess; this is most readily resolved by repeated measurements.

Figure 3 illustrates one over-all design which takes into consideration the need for specificity in protocols, for reinforcement of both screener and patient by color-coded cards, and for a means of recording the factors which help in forming the blood-pressure profile of the individual. Normal blood pressures (yellow code) and those exceeding 115 mm. Hg diastolic (red code) require only one visit. Borderline and abnormal blood pressure

HYPERTENSION DETECTION AND CONTROL PROGRAM

	Less than 140 / 90 mmHg Normal	140-159 / 90-94 mmHg Borderline	160 or more / 95-114 mmHg Abnormal	Any number / 115 mmHg or more Abnormal
Visit # 1				
2				
3				
4				
5				
6				

Positive Factors	Check
Black or Latin	____
Youth (Less than 40 years)	____
Family History	____

RESULT	RECOMMENDATION
1. DIASTOLIC BLOOD PRESSURE IS HIGHER THAN 115	IMMEDIATE REFERRAL TO DOCTOR
2. WHEN THE NUMBER OF ABNORMAL OR BORDERLINE BLOOD PRESSURES IS GREATER THAN THE NUMBER OF NORMAL BLOOD PRESSURES	REFER TO THE DOCTOR
3. WHEN ONE OR MORE POSITIVE FACTORS ARE PRESENT AND THE BLOOD PRESSURE IS ABNORMAL	REFER TO THE DOCTOR

Fig. 4. A profile chart of blood pressure for the individual patient incorporates instructions for the screening team. Provision is made for serial determinations, which are especially necessary in persons with borderline levels of blood pressure and in those with highly variable patterns (especially adolescents and young adults).

require follow-up—the most effort and persistence being given to those with positive factors of race, age, and family history.[4] Sex is not recorded, since black females have been shown to be as vulnerable as black males to dysfunction of target organs resulting from hypertension.

A profile chart of blood pressure for the individual provides space for sequential measurements (Figure 4). Persons who have borderline blood pressure or who show the marked variability seen in adolescents require serial measurements for determination of the individual pattern. Recommendations are incorporated into the chart in order to reinforce the protocol. The decision made at the screening center concerns whom and when to *refer* rather than whom and when to *treat*.

These considerations regarding blood pressure screening in adults require further emphasis and some modification for adolescents. Before an attempt is made to define abnormal blood-pressure levels in adolescents, the characteristics of normal blood pressure in this group must be defined.

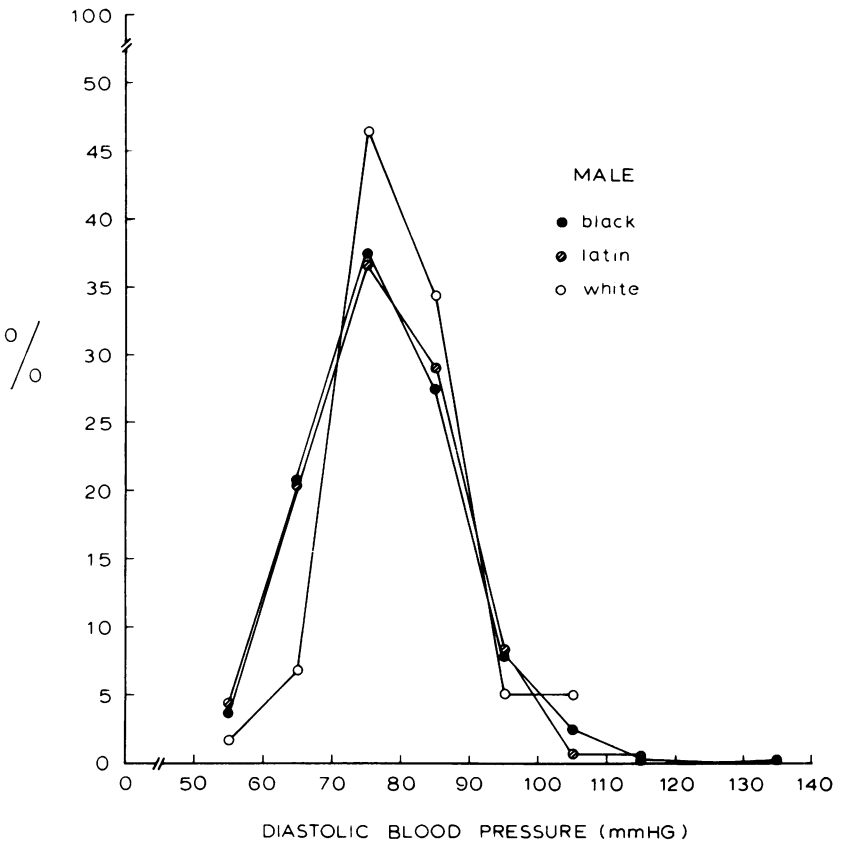

Figure 5. The frequency-distribution curve of diastolic blood pressure in male adolescents aged 14 to 19 years shows two characteristics of normal blood pressure behavior in this age group: the range of pressures is lower than in adults and there is no racial distinction in the normal curve. Reproduced by permission from the American Heart Association, Inc., and Kilcoyne, M. M., Richter, R. W., and Alsup, P.: Adolescent hypertension. I. Detection and prevalence. *Circulation 50:*758, 1974.

The frequency-distribution curve of blood pressures obtained in 3,537 high school students aged 14 to 19 years in New York City[5,6] reveals four characteristics. Figure 5 illustrates two of these: 1) the normal range of both systolic and diastolic pressure is lower in adolescents than in adults and 2) there is no racial difference in the blood-pressure curve at this age. Third, a lower range of systolic blood pressures was observed in female than in male adolescents. These factors are important in establishing the criteria which may serve as a group reference in the determination of

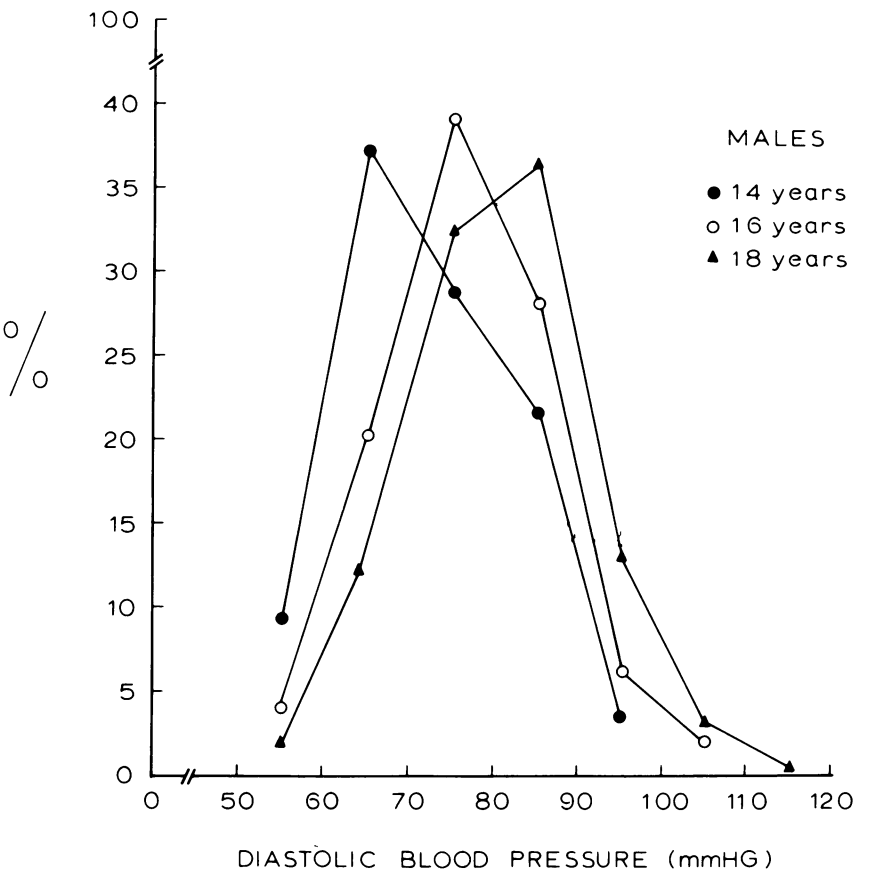

Fig. 6. The sequential rise in blood-pressure levels from normal childhood values toward those of adulthood occur during adolescence and are most pronounced in males (shown above) between the ages of 14 and 18 years. Reproduced by permission from the American Heart Association, Inc., and Kilcoyne, M. M., Richter, R. W., and Alsup, P.: Adolescent hypertension. I. Detection and prevalence. *Circulation 50:*758, 1974.

abnormal levels at this age. The use of standard adult criteria in adolescents would underestimate the prevalence of hypertension at this age, especially in females. At present it seems advisable to consider the following levels (mean + 2 standard deviations) to be in the hypertensive category when persistent: females > 135/92 mm. Hg; males > 145/95 mm. Hg. Adolescents who have blood pressures sustained at the following levels (mean + one standard deviation) deserve continued observation: females > 123/82 mm. Hg; males > 135/85 mm. Hg.

Although definition of blood-pressure categories for a group may be achieved by analysis of the frequency-distribution curve, the blood-pressure profile of the individual is particularly difficult to define in adolescents. In Figure 6 the fourth characteristic of normal blood-pressure behavior at this age is apparent. During adolescence the blood-pressure baseline shifts from a level that is normal for childhood toward the range ordinarily found in adults. This normally dynamic system, then, has a superimposed state of flux during the years of maturation, so that variability in blood-pressure measurements is markedly increased. Therefore, serial measurements must be made in any adolescent before the individual blood-pressure profile is defined. That this should take place within the setting of the school is consonant with the concept of a stable site for screening and with the larger concept of linking health and education for the benefit of society.

REFERENCES

1. Kilcoyne, M. M.: Hypertension and heart disease in the urban community. *Bull. N.Y. Acad. Med. 49:*501, 1973.
2. National Center for Health Statistics: *Hypertension and Hypertensive Heart Disease in Adults, United States 1960-1962*. Public Health Service Publ. No. 1,000, Series 11, No. 13. Washington, D.C., Govt. Print. Off., 1966.
3. Wilber, J. A.: Detection and Control of Hypertensive Disease in Georgia. In: *The Epidemiology of Hypertension*, Stamler, J., Stamler, R., and Pullman, T. N., editors. New York, Grune and Stratton, 1967, p. 439.
4. Freis, E. D.: The clinical spectrum of essential hypertension. *Arch. Intern. Med. 133:*982, 1974.
5. Kilcoyne, M. M.: Adolescent hypertension: Considerations for therapy. *Circulation* (Suppl.) *49, 50:*111-24, 1974.
6. Kilcoyne, M. M., Richter, R. W., and Alsup, P.: Adolescent hypertension I. Detection and prevalence. *Circulation 50:*758, 1974.